

CLAIMS

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is as follows:

1 1. A method for a virtual machine in which compilation
2 of a procedure is performed by:

3
4 A) generating a persistent image, ahead of run time, that
5 contains code for that procedure, and performing the
6 following steps at run time.

7
8 B) checking for the existence and validity of a code
9 image for said procedure.

10
11 C) adapting the code image to the current execution
12 context.

13
14 D) using run-time compilation of the procedure if its
15 code image does not exist, is invalid, or cannot be
16 successfully adapted to the new execution context.

1 2. Method of claim 1, where the virtual machine is a Java
2 Virtual Machine.

1 3. Method of claim 1, where the persistent image in step
2 A is generated by a run-time compiler during a prior
3 execution of a program containing said procedure.

1 4. Method of claim 1, where the persistent image in step
2 A is generated by a static compiler.

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1 5. Method of claim 3, where any method not compiled by
2 the run-time compiler during said prior execution is
3 compiled in an offline manner in order to produce its
4 persistent code image.

1 6. Method of claim 1, where the validation check in step
2 B includes checking the virtual machine version recorded
3 in the code image.

1 7. Method of claim 1, where the validation check in step
2 B includes checking the operating system version recorded
3 in the code image.

1 8. Method of claim 1, where the validation check in step
2 B includes checking the target architecture
3 identification recorded in the code image.

1 9. Method of claim 1, where the validation check in step
2 B includes checking the timestamp of the generated code
3 in the code image.

1 10. Method of claim 1, where the validation check in step
2 B includes checking the timestamp of the said procedure's
3 source code or intermediate code being compiled.

1 11. Method of claim 1, where the validation check in step
2 B includes checking a digest of the generated code for
3 said procedure in the code image.

1 12. Method of claim 1, where the validation check in step
2 B includes checking the timestamp of one or more

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procedures' source code or intermediate code on which the code for the said procedure is dependent.

13. Method of claim 1, where the validation check in step B includes checking a digest of one or more procedures' source code or compiled code on which the code for the said procedure is dependent.

14. Method of claim 1, where:

step A is further modified to generate code annotations which identify instructions that are dependent on the current execution context and which allow parameters valid for the new execution context to be deduced, and

adaptation of code image in step C is performed by using the annotations recorded by the modified step A described above.

15. Method of claim 14, adaptation of code image in step C involves adding extra instructions into the said code.

16. Method of claim 1, where step D uses interpretation instead of run-time compilation of the procedure if its code image does not exist, is invalid, or cannot be successfully adapted to the new execution context.

17. Method of claim 1, where the persistent code image is stored in a file.

18. Method of claim 1, where the persistent code image is stored in a memory device of the computer.

1 19. Method of claim 1, where a single persistent code
2 image contains code for one or more procedures declared
3 in a class in the user program or library.

1 20. Method of claim 2, where a single persistent code
2 image contains code for a single Java class.

21. Method of claim 2, where a single persistent code
image contains code for a single Java package.

22. Method of claim 1, where the code for all procedures stored in a persistent code image is read at run-time when any procedure code resident in that image is first read.

1 23. A system for operating a virtual machine in which
2 ~~compilation of a procedure is performed by:~~

4 A) means for generating a persistent image, ahead of run
5 time, that contains code for that procedure;

7 B) means for checking, at run time, for the existence and
8 validity of a code image for said procedure;

10 C) means for adapting, at run time, the code image to the
11 current execution context; and

13 D) means for using run-time compilation of the procedure
14 if its code image does not exist, is invalid, or cannot
15 be successfully adapted to the new execution context.

1 28. A program storage device according to Claim 27, where
2 the persistent image in step A is generated by a run-time
3 compiler during a prior execution of a program containing
4 said procedure.

1 29. A program storage device according to Claim 27, where
2 the persistent image in step A is generated by a static
3 compiler.

1 30. A program storage device according to Claim 27, where
2 the virtual machine is a Java Virtual Machine.

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